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Is Financial Development Bad for Growth?☆

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Abstract

Is financial development good for growth? In new data, we find that the growth effect of bank credit-to-GDP ratios - the traditional measure for financial development - is on average negative for 46 economies over 1990-2011. We explain this by the changing composition of credit. Financial development since 1990 was mostly due to growth in credit to real estate and other asset markets. The share of credit to nonfinancial business in total credit decreased sharply. We find negative growth coefficients for credit-to-GDP stocks supporting asset markets. In contrast, we estimate robustly positive growth effects of credit flows to nonfinancial business and insignificant effects of credit flows to asset markets, including real estate. The positive growth effect of credit flows diminishes at higher levels of financial development. Our findings are in line with recent suggestions that high ratios of financial capital to GDP since the 1990s may depress growth, through real negative returns to capital (Summers, 2013; Piketty, 2014). Even though credit flows may give a short-term stimulus to growth, the longer term effect of financial development is negative.

Keywords: credit, growth, stocks, flows, dynamic panel analysis
JEL: E44, O16, O40, C33

☆For helpful comments on earlier drafts of this paper we thank seminar participants in the June 2013 EWEPA conference in Helsinki, the September 2013 2nd IES seminar in Prague, the October 2013 IMK conference in in Berlin, the October 2013 NED conference in Amsterdam, November 2013 research seminars in Groningen and Stirling, and the April 2014 Royal Economic Society conference in Manchester. Thanks especially to Joeri Schasfoort and Anna Samarina for help in organizing the data. Any remaining errors or omissions are ours. We acknowledge generous financial support from the Equilibrio Foundation and the Institute for New Economic Thinking.

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1. Introduction

The growth effectiveness of bank credit has markedly declined since the 1990s. In this paper we make three contributions to understanding the contemporary credit-growth relation. First, we present and analyze new data for 46 economies over 1990-2011. We observe that the growth of credit relative to GDP since 1990 was mostly due to a rise in credit to real estate and other asset markets, rather than credit to nonfinancial business. Second, we distinguish the (positive) flow effect of credit from the stock effect. We find that the growth coefficient of bank credit stocks, traditionally used to measure financial development, is insignificant or negative, in contrast to earlier literature. We explain this by the unprecedented shift in the composition of credit in recent decades, away from non-financial business and towards real estate asset markets. Third, we estimate positive growth coefficients for credit flows, most clearly for credit to nonfinancial business. Our findings are in line with recent suggestions that high ratios of capital to GDP since the 1990s, may depress growth through real negative returns to capital or through inequality (Summers, 2013; Piketty, 2014). Credit flows may give a short-term stimulus to growth, even as the longer term effect of financial development is negative. The implications of these findings suggest several lines of research, as we discuss in the concluding section.

A large empirical literature had established the positive effects of the growth in bank credit on output growth, in data from the 1960s until the mid 2000s.[1] Recent research however shows that above a threshold level, a high credit-to-GDP ratio may slow down growth (Shen and Lee, 2006; Arcand et al., 2012; Cecchetti and Kharroubi, 2012). Credit-growth correlations which were positive until the 1990s (Levine, 2005; Ang, 2008) have declined over time and they are insignificant or negative since (Rousseau and Wachtel, 2011; Valickova et al., 2013). Wachtel (2011) questions the interpretation of credit/GDP ratios as indicating financial deepening, and notes it may also indicate increasing financial fragility. Beck et al. (2014) distinguish between the financial sector's 'intermediation activities' (which they find increases growth) and its size (which has no effect on growth). Arcand et al. (2012) use different empirical approaches to show that there can indeed be 'too much finance'. Cecchetti et al. (2011) observe that "beyond a certain level, debt is a drag on growth." Cecchetti and Kharroubi (2012) conclude that "there is a pressing need to reassess the relationship of finance and real growth in modern economic systems. More finance is definitely not always better.".

Different explanations have been proposed. Rousseau and Wachtel (2011) note that the positive finance-growth relationship that was estimated using the data from 1960 to 1989 disappears in the subsequent 15 years as a result of the incidence of financial crises. They suggest that since the 1990s, many countries liberalized their financial markets before the associated legal and regulatory institutions were sufficiently well developed, undermining the positive impact of financial deepening on growth. In our empirical work we will control for crises and for the level of institutional development. Arcand et al. (2012) develop a model in which the expectation of a bailout may lead to a financial sector which is too large with respect to the social optimum. Cecchetti and Kharroubi (2012) present evidence that more skill intensive and R&D intensive industries suffer more productivity losses during a financial boom. If skilled labor is drawn into finance during a credit boom, the financial sector may grow at the expense of the real sector. Earlier, Stockhammer (2004) analyzed a causal relation for selected OECD economies between expanding asset markets and a slowdown in fixed capital formation. Easterly et al. (2000) show that the volatility of growth tends to decrease and then increase with increasing financial depth.

We present new data, new evidence and a new explanation of the contemporary credit-growth relation. We distinguish nonfinancial business credit and consumption credit on one hand, and financial-business credit and mortgages on the other hand - or briefly, 'nonfinancial' credit and 'asset market' credit. We also distinguish between the effect of credit flows and the effect of credit stocks (Biggs et al., 2010). We collected bank credit data from central bank sources in 46 economies over 1990-2011 and find that the share of nonfinancial credit in total credit decreased substantially, with strong growth of credit stocks relative

[1] This literature builds on Schumpeter (1934), Schumpeter (1939), Goldsmith (1969), McKinnon (1973) and Shaw (1973). Levine (2005) and Ang (2008) provide overviews. The latest year analyzed is 2005.

to GDP. We observe positive correlations of nonfinancial credit flows with economic growth, and negative correlations of credit stocks with growth.

These findings hold up in fixed-effect panel data regressions, dynamic panel estimations (system-GMM models), in regressions with Rajan and Zingales (1998)'s methodology, and in a battery of robustness checks. Thus, our explanation of credit's declined growth effectiveness is the shift in credit composition towards credit stocks supporting asset markets, which have negative growth effects. By stimulating the growth in debt but not the growth in output, this shift towards more credit to asset markets implied faster growth of debt stocks relative to GDP. This may be harmful in itself for all the reasons outlined above (Wachtel, 2011; Rousseau and Wachtel, 2011; Arcand et al., 2012; Cecchetti and Kharroubi, 2012; Schularick and Taylor, 2012; Jordà et al., 2013).

Section 2 elaborates the argument. In section 3 we present the new data. Sections 4 and 5 present the methodology and empirical findings. Section 6 concludes the paper with a summary, discussion and conclusions.

2. The uses of credit

In our analysis of new data over 1990-2011 for 46 economies, we cannot detect a positive growth effect of credit, on average. Coefficients of the credit-to-GDP ratio are negative or insignificant, depending on the estimation method. This has not been found before and in view of the earlier literature, it appears puzzling.

We suggest that a key part of the solution to this puzzle is the change in the composition of credit. In the credit-growth literature to date, 'credit' is commonly interpreted as credit to the nonfinancial sector, supporting production of goods and services. With only nonfinancial-sector credit, the dynamics of credit, debt and capital are identical so that the growth effect of credit can indeed only be positive. The depth of financial markets can be viewed simply as a measure of economies' productive absorption capacity (Masten et al., 2008). Negative growth coefficients of credit, such as we find, present a puzzle.

In contrast, if we include in the analysis credit which finances transactions in assets (rather than in goods and services), the growth coefficient need not be positive. Part of credit growth may now inflate asset markets rather than leading to growth in GDP. Growth in credit can outpace the economy's capacity to productively absorb financial resources (Boissay et al., 2013). This decreases the credit-growth correlation and it increases growth of credit-to-GDP ratios, since credit stocks grow without (or with much less) growth in GDP. Indeed, growth coefficient of large mortgage debt stocks may well be negative, for reasons outlined above. What matters is "how large a credit boom [is] relative to the possibilities of productive uses for loans." (Lorenzoni, 2008; Boissay et al., 2013).

Strong growth of credit, with a shift towards credit to asset market rather than nonfinancial business, is indeed a distinct feature of the data. Credit booms in the 1990 and 2000s caused credit to asset markets to become a large (sometimes the largest) part of bank credit. For instance, in the Netherlands, credit to asset markets (mostly, household mortgage credit) accounted for 70% of outstanding bank loans in 2011, up from less than 50% in 1990. The common inclusion of mortgage credit in credit-to-GDP ratios, and the rise in its share, helps explain credit's declining growth effectiveness.

Precursors to this argument in the literature include Jappelli and Pagano (1994), who argue that more household credit leads to lower private savings and so slower economic growth. Beck et al. (2012) confirmed that credit to households (most of which is mortgages, in most economies) has negligible growth effects, while credit to nonfinancial business has strong growth effects. Büyükkarabacak and Valev (2010) and Büyükkarabacak and Krause (2009) find that countries with more household credit have higher probabilities of crisis and weaker external balances. Jappelli et al. (2008), Barba and Pivetti (2009) and Sutherland et al. (2012) find positive crisis and recession effects of the expansion of household credit, respectively. Our data allow us to link growth of household mortgage debt to the rise in overall debt levels, which has been widely noted as a growth retarding factor (Radelet and Sachs, 1998; Wachtel, 2011; Rousseau and Wachtel, 2011; Lorenzoni, 2008; Barajas et al., 2013; Reinhart, 2010; Schularick and Taylor, 2012; Jordà et al., 2013; Boissay et al., 2013). For instance, Figure 2 in the next section shows in a cross section of countries over 1990-2011 that total private debt to domestic banks rose from below 80% to over 120% of GDP, with mortgage credit rising from 20% to 50% and credit to nonfinancial business remaining stable around 40% of

GDP. Combining this with a negative growth coefficient of mortgage credit - and of bank credit to asset markets generally - helps understand why financial development was not good for growth in 1990-2011.

A second part of understanding negative financial development effects is the distinction between stocks and flows of credit. They relate to GDP growth in different ways (Biggs et al., 2010). Credit flows increase agents' ability to finance expenditures. This is a direct short-term 'liquidity effect' on output, since "[l]oans cause deposits and those deposits cause an expansion of transactions" (Caporale and Howells, 2001; Borio and Lowe, 2004). This 'expansion of transactions' will be GDP growth insofar transactions of goods and services (not of assets) are involved. Indeed, we find positive growth coefficients of credit flows to nonfinancial business but insignificant growth coefficients of credit flows that finance asset transactions, including real estate.

Meanwhile, these credit flows increase credit stocks. Credit stock measures capture agents' ability to use finance to reallocate factors of production, which may support growth. This is the traditional, positive 'financial development' effect on growth (King and Levine, 1993). But credit stocks are also debt stocks, which may depress growth through more financial fragility and larger uncertainty, through larger debt servicing out of income, through a negative wealth effect on consumption and in other ways outlined above. Theoretically, the growth effect of credit stocks is ambiguous; with very large credit stocks, it may well be negative.

This stock-flow distinction is new to the empirical credit-growth literature but there is a clear parallel in the fiscal macro literature. Flows of government deficit spending may boost growth in the short term, but by simultaneously raising stocks of public debt they may decrease longer term growth. The (positive) impact of deficits differs from the (negative) impact of debt. What goes for public debt, goes for private debt. In addition to our new data, our second innovation is therefore to analyse credit stocks and credit flows separately. We will find larger negative growth effects of financial development (measured by credit stocks scaled by GDP) when controlling for the positive effect of credit flows.

3. Data

We collected data from the consolidated balance sheets of monetary financial institutions in central bank sources, for 46 countries over 1990-2011. On the asset side of the balance sheet, loans to nonbanks are reported separately as mortgages to households, household consumption credit, credit to nonfinancial business, and credit to financial business (insurance, pension funds, and other nonbank financial firms).[2] To the best of our knowledge, no data with similar detail has been collected and reported before.[3] In the Data Appendix we report sources and compare our data to other data sets. In this section we introduce definitions for the key variables in the analysis: stocks and flows of credit categories. We discuss their development over time and across countries.

3.1. Measuring stocks and flows of credit categories

We define credit stocks as the credit-to-GDP ratio:

$$s_{i,t} = \frac{C_{i,t}}{GDP_{i,t}} \tag{1}$$

where i denotes country, t denotes time and C is a credit measure. We measure credit flows by the annual change of credit stocks relative to lagged GDP, as follows (Biggs et al., 2010):

$$f_{i,t} = \frac{C_{i,t} - C_{i,t-1}}{GDP_{i,t-1}} \tag{2}$$

[2] A fifth category is bank lending to government, which is however often not reported and in any case mostly small.

[3] Related data sets are in Beck et al. (2012) (which ends in 2005 and does not have 15 countries included in our data) and BIS (2013) which include both bonds and bank credit and does not differentiate bank credit. We refer to the Data Appendix for a comparative discussion.

We aggregate the four types of credit into two broader categories: 'nonfinancial' credit (credit to nonfinancial business plus household consumption loans) and 'asset market' credit (mortgages plus credit to financial business). The latter follows the 'finance, insurance and real estate' sectors classification of the U.S. National Income and Product Accounts.[4] We aggregate into two categories for reasons of parsimony in presentation; alternative aggregations are possible but do not qualitatively affect our results. For robustness purposes, we analyze growth effects of all four types of credit below. We will find that the decisive distinction is between household mortgages and nonfinancial business credit. As a broad distinction, this categorization will help us trace the effects of different types of credit on GDP growth.[5]

3.2. Trends in the data

Three features stand out in the 1990-2011 data: the expansion of credit relative to GDP over time (Figure 1), the changing composition of credit stocks (Figure 2), and the correlation of stocks and flows of credit categories with economic growth (Figure 3). Figure (1a) shows that for a balanced panel of 14 countries in our data - selected on data availability -, on average the total-credit-to-GDP ratio increased from 75% to 120% over 1990-2011. The increase is pronounced in both developed countries and emerging countries. Figure (1b) shows the trends for 5 selected developed economies. In Spain, the credit-to-GDP ratio rose over 1992-2011 from 118% in 1992 to 389% at the time of the 2008 financial crisis. The increases are also pronounced in the Netherlands, from 77% to 210%; in Greece, from 33% to 115%; and in the UK, from 39% to 90% over the 1990-2011 period. Figure (1c) for emerging economies shows that here much of the increase in the credit-to-GDP ratio occurred in the 2000s. In Croatia for instance, the credit-to-GDP ratio went from 55% in 2001 to 150% in 2011. Declines were rare and often associated with episodes of financial crisis. The average of country credit ratios peaked and then declined slightly after the 2008 financial crisis.

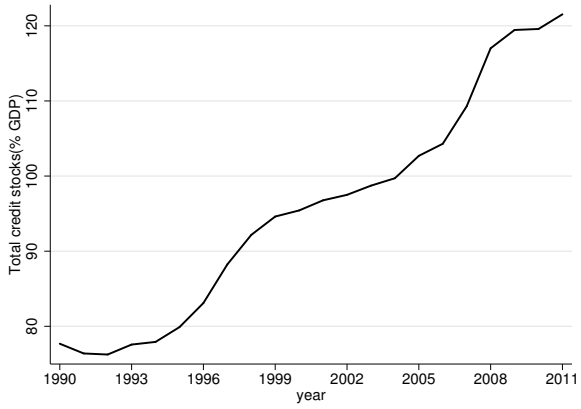
A second trend is the changing composition of credit. Table A1 in the Data Appendix shows that on average, lending to nonfinancial business and household mortgage lending are the two principal credit categories. Figure (2a) shows that most of the growth in the credit-GDP ratio is due to growth of credit to asset markets, especially mortgage credit (bank credit to nonbank financials is small in these data). The ratio of nonfinancial credit to GDP is roughly stable over time around 40%. We study the shifting credit composition in more detail. Figure (2b) first illustrates that the share of nonfinancial credit in total credit varies considerably across countries. It appears to be negatively correlated to income levels. Figure (2c) shows the shift in credit composition over time. The vertical distance to the diagonal measures a country's shift in the share of nonfinancial credit in total credit between its first and last observation. The share was nondeclining in 10 countries, positive in one and falling in all others.

A third observation is on the credit-growth relation, for stocks and flows of credit. Table 1 presents the growth correlations of stocks and flows of the two credit aggregates and the four categories of credit. There appears to be a robustly negative cross-section relation over 1990-2011 of credit stocks relative to GDP with real per capita GDP growth, though with significant scatter and possible nonlinearity around the trend line (Figure (3a)). There also appears to be a positive correlation over time of per capita output growth with total-credit flows (Figure (3b)). Panel A in the Table shows that the negative correlation of credit stocks with growth is mainly driven by mortgages and (to a lesser extent) financial-sector credit. The correlation of growth with credit to all asset markets is less negative and less significant. Flows of nonfinancial credit have the highest correlation with growth, closely followed by its two components, nonfinancial business credit and household consumption loans. Growth correlations of credit flows to financial business and household mortgage credit flows are much smaller. We also note the large correlations of total credit stocks with mortgage credit stocks.

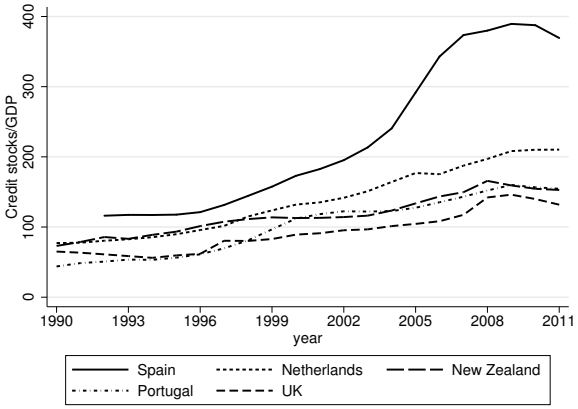
[4] In this respect, the present paper differs from other studies which distinguish between credit into 'enterprise' and 'household' credit (Beck et al., 2012; Büyükkarabacak and Valev, 2010; Büyükkarabacak and Krause, 2009). In practice the difference is not a large

Figure 1: Developments of bank credit stocks

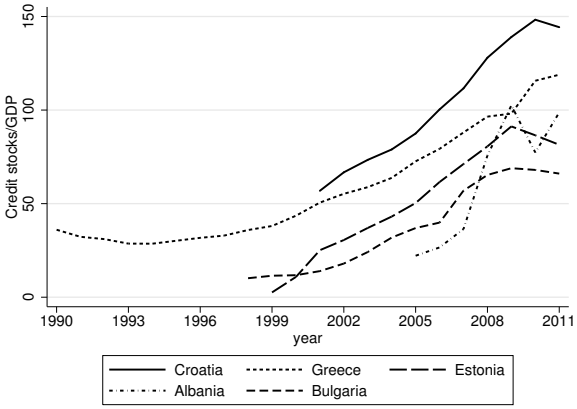
(a) Total bank credit stocks over 1990-2011



(b) Total bank credit stocks for selected developed countries



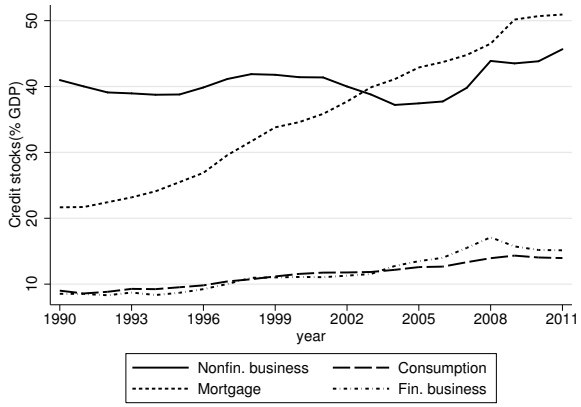
(c) Total bank credit stocks for selected emerging countries



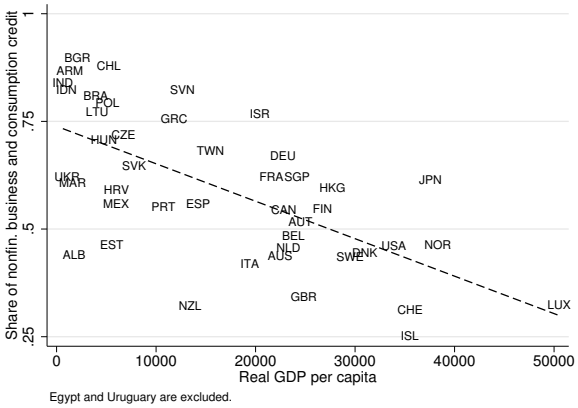
Note: Panel (1a) plots the unweighted average based on authors' own calculations for a balanced panel of 14 countries, namely Canada, Switzerland, Chile, Germany, UK, Greece, Hong Kong, Hungary, Japan, Netherlands, New Zealand, Portugal, Singapore and United States.

Figure 2: Developments in credit composition

(a) Different types of bank credit stocks over 1990-2011

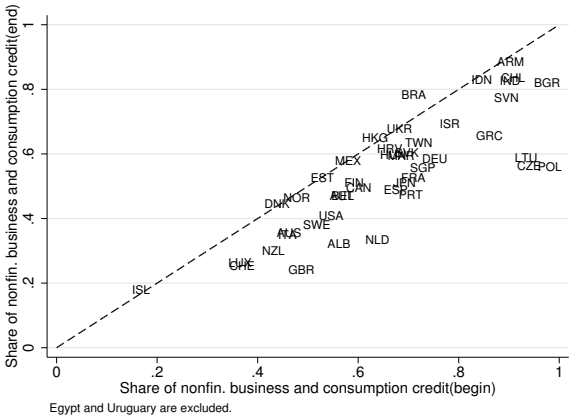


(b) The heterogeneity of credit composition



Egypt and Uruguary are excluded.

(c) The dynamics of credit composition over time

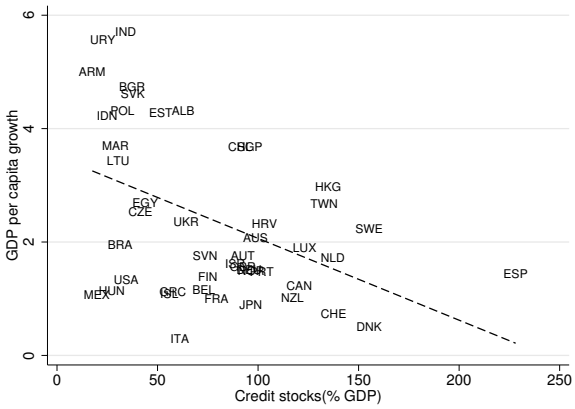


Egypt and Uruguary are excluded.

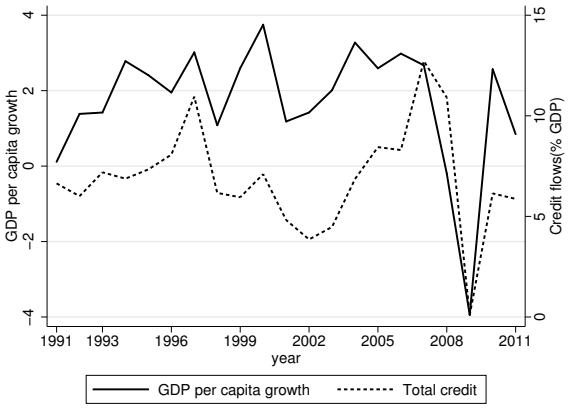
Note: Panel (2a) plots the unweighted averages based on authors' own calculations for a balanced panel of 14 countries. Panel (2b) and (2c) are based on an unbalanced panel of 44 countries, excluding Egypt and Uruguay in which the share of non financial business and consumption credit was equal to one throughout.

Figure 3: Credit stocks, credit flows and economic growth over 1990-2011

(a) Credit stocks and growth



(b) Credit flows and growth



Note: Panel (3a) is based on authors' own calculations for the whole sample of 46 countries, whereas panel (3b) is based on a balanced panel of 14 countries indicated above.

Table 1: Do credit stocks and flows correlate with economic growth?

	GDP p.c. growth	Total credit	Nonfinancial sector	Financial sector	Non-financial credit	Consumer credit	Mortgage credit	Fin. Bus. credit
Panel A: Stocks								
GDP p.c. growth	1							
Total credit	-0.324***	1						
Nonfinancial sector (a+b)	-0.282***	0.827***	1					
Financial sector (c+d)	-0.287***	0.917***	0.535***	1				
a. Non-financial business	-0.275***	0.786***	0.965***	0.497***	1			
b. Consumer credit	-0.190*	0.622***	0.710***	0.432***	0.502***	1		
c. Mortgage credit	-0.312***	0.903***	0.606***	0.928***	0.543***	0.542***	1	
d. Fin. business credit	-0.147	0.626***	0.231**	0.777***	0.248**	0.097	0.488***	1
Panel B: Flows								
GDP p.c. growth	1							
Total credit	0.27***	1						
Nonfinancial sector (a+b)	0.313***	0.802***	1					
Financial sector (c+d)	0.147	0.856***	0.377***	1				
a. Non-financial business	0.273***	0.782***	0.952***	0.373***	1			
b. Consumer credit	0.282	0.440***	0.568***	0.19*	0.35***	1		
c. Mortgage credit	0.104	0.748***	0.384***	0.826***	0.356***	0.274***	1	
d. Fin. business credit	0.131	0.605***	0.203*	0.761***	0.228**	0.01	0.263***	1

Note: This table reports pairwise correlation coefficients between growth and different types of credit stocks and flows, *** p<0.01, ** p<0.05, * p<0.1.

4. Empirical Strategy

We regress real GDP per capita growth on annual stocks and flows of total credit and of the two credit aggregates, controlling for other determinants of growth commonly used in the finance-growth literature. We start with a fixed-effect panel data baseline model over 1990-2011 for 46 countries. Then we estimate system-GMM and difference-in-difference models to account for endogeneity. in this section we discuss these three specifications. As in many finance-growth studies, we use 3-year averages of the underlying annual data. The baseline specification is:

$$g_{i,t} = \alpha + \beta_1 s_{i,t} + \beta_2 f_{i,t} + \gamma X_{i,t} + \varphi_i + \phi_t + \epsilon_{i,t} \tag{3}$$

where $g_{i,t}$ is the growth rate of real GDP per capita (2000 constant US dollar) of country i in three-year period t; Coefficients β_1 and β_2 capture the relations of credit stocks ($s_{i,t}$), and credit flows ($f_{i,t}$) with growth, respectively, where we will estimate a total-credit measure, 'nonfinancial' credit and 'asset market' credit separately. X_{it} is a vector of control variables, including the level of real GDP per capita at the beginning of t, trade openness (imports plus exports as a percentage of GDP), government expenditure as a share of GDP, inflation, education (average years of schooling of the adult population) and a composite country risk indicator as a proxy for institutional quality, ranging from 50 (low institutional quality) to 100 (high institutional quality). We include unobserved country-specific time-invariant effects in φ_i and simultaneous shocks across countries in time dummies ϕ_t. Lastly, $\epsilon_{i,t}$ is the white noise error term with mean zero. Below we will also include an interaction term of credit flows with credit stocks and a systematic banking crises indicator (Laeven and Valencia, 2013). All country-level variables are taken from the World Bank Development Indicators, except education (which is retrieved from the Barro and Lee (2013) database) and institutional quality, extracted from the International Country Risk Guide (ICRG) database. Table 2 summarizes the definitions, sources and descriptive statistics of country-level variables used in our analysis.

Since it is always possible that higher growth causes acceleration of lending (rather than the other way round), the baseline specification (3) may suffer from endogeneity. One way to account for this is to estimate a generalized-method-of-moments (GMM) dynamic panel model (Arellano and Bover, 1995; Blundell and Bond, 1998). This combines regressions in levels and in differences, yielding unbiased estimators for the coefficients of interest. We difference (3) to obtain:

$$\triangle g_{i,t} = \beta_1 \triangle s_{i,t} + \beta_2 \triangle f_{i,t} + \gamma \triangle X_{i,t} + \triangle \phi_t + \triangle \epsilon_{i,t} \tag{4}$$

and then estimate equations (3) and (4) using system-GMM estimation where the endogenous credit variables are instrumented by their lags in equation (4). We use lagged differences as instruments for the levels equation (3) and lagged variables in levels as instruments for the differenced equation (4). The consistency of the GMM estimator depends on the validity of instruments and on the validity of the assumption that the error term, $\epsilon_{i,t}$, does not exhibit serial correlation. We apply Hansen test for over-identifying restrictions, testing for the overall validity of the instruments, along with a test for second order serial correlation of the residuals.

Third, we will use Rajan and Zingales (1998)'s methodology to account for the endogeneity of credit to growth. They utilize an industry-specific index of external financial dependence, defined as capital expenditures minus cash flow from operations divided by capital expenditures. They rank industries by their external dependence on finance and observe that industries that are more dependent on external finance grow faster in countries with more developed financial systems, measured as the credit-to-GDP

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one on average as credit stocks to financial business and household consumption credit are both relatively small.

[5]While this delineation is useful, its measurement is necessarily imprecise. For instance, mortgage credit often also serves as consumer credit through home equity withdrawals, while business credit includes business mortgage credit. Conversely, nonfinancial businesses realize part of their returns in trading financial assets (see e.g. Krippner, 2005 on the U.S.)

Table 2: Descriptive Statistics (3-year averaged data)

Variable	Source	Unit	Obs	Mean	Std	Min	Max
Credit Stocks							
Total credit	Own Calculation	% of GDP	237	82.174	50.941	9.82	381.584
Credit aggregates							
Nonfinancial credit	Own Calculation	% of GDP	237	45.135	25.504	5.944	187.026
Credit to asset markets	Own Calculation	% of GDP	228	38.501	32.206	0.245	194.559
Credit categories							
Non-financial business	Own Calculation	% of GDP	237	35.594	18.226	5.565	92.696
Consumer	Own Calculation	% of GDP	206	10.976	12.458	0.221	94.33
Mortgage	Own Calculation	% of GDP	228	30.273	27.386	0.245	194.559
Financial business	Own Calculation	% of GDP	191	9.822	12.302	0.058	76.323
Credit Flows							
Total credit	Own Calculation	% of lagged GDP	228	7.406	7.517	-4.335	70.305
Credit aggregates							
Real-sector	Own Calculation	% of lagged GDP	228	3.74	4.239	-4.612	32.055
Financial-sector	Own Calculation	% of lagged GDP	219	3.816	4.44	-2.931	38.249
Credit categories							
Non-financial business	Own Calculation	% of lagged GDP	228	2.801	3.217	-4.771	16.767
Consumer	Own Calculation	% of lagged GDP	199	1.075	1.779	-1.803	15.288
Mortgage	Own Calculation	% of lagged GDP	219	2.976	3.617	-2.825	38.249
Financial business	Own Calculation	% of lagged GDP	183	1.006	2.327	-2.621	21.978
Other Variables							
GDP per capita growth	WDI	Percentage points	237	2.306	2.475	-7.602	12.629
Initial GDP per capita	WDI	In log	237	9.323	1.095	6.142	10.913
Trade openness	WDI	% of GDP	237	94.554	76.798	15.546	424.013
Government size	WDI	% of GDP	237	17.81	4.805	7.197	28.413
Inflation	WDI	Percentage points	237	4.431	6.679	-3.123	66.008
Education	Barro and Lee (2012)	Years	237	9.553	2.202	3.472	13.262
Institution	ICRG	Index	237	78.433	6.992	60.867	92.067
Crisis	Laeven and Valencia (2012)	Dummy variable	237	0.11	0.313	0	1

Note: 'Total credit' was computed only for country-year observations where there was at least one nonzero observation for nonfinancial credit and one observation for asset market credit.

ratio. By exploiting cross-industry variations while controlling for a range of country-specific and industry-specific factors, this widely used methodology alleviates endogeneity concerns.[6] In contrast to past studies based on cross sectional data (including Rajan and Zingales, 1998), we use panel data. Our approach has two distinctive features compared to similar analyses. First, we are able to control for a wider range of industry-time and industry-country fixed effects. This alleviates omitted variables bias. Second, by including the credit variable itself, in addition to its interaction with financial dependence, our specification allows for an assessment of the direct effect of credit on industry-level growth. Our specification is:

$$growth_{j,i,t} = \theta_0 share_{j,i,t_0} + \theta_1 s_{i,t} + \theta_2 s_{i,t} \times ED_j + \theta_3 f_{i,t} + \theta_4 f_{i,t} \times ED_j + +\mu_j + \varphi_i + \phi_t + \delta_{j,t} + \eta_{j,i} + \gamma X_{i,t} + \epsilon_{j,i,t} \tag{5}$$

where j denotes industry, i denotes country and t denotes time (i.e., a 3-year period). This specification is closely related to Braun and Larrain (2005); *growth* is measured as the annual percentage change of industry real value added.[7] *Share* is defined as the size of each industry as a percentage of manufacturing value added at the beginning of each 3-year period. Similar to our country-level specifications above, s and f denote the stocks and flows of credit categories. ED is the external financial dependence indicator, taken from Rajan and Zingales (1998). We include a series of dummy variables to control for industry- (μ_j), country- (φ_i), time- (ϕ_t), industry-time ($\delta_{j,t}$) and industry-country ($\eta_{j,i}$) fixed effects. We include the same vector of control variables $X_{i,t}$ as in equation (9) and (10), which vary at the country-time dimension. Finally, $\epsilon_{j,i,t}$ is an error term.

Our industry-level analysis covers an unbalanced panel of 36 ISIC three- and four-digit manufacturing industries for 41 countries during 1990-2011 from the United Nations Industrial Development Organization Industrial Statistics Database (INDSTAT4). We ensure that the number of industries available through time is constant across each individual country, while the number of industries across countries may vary. Table A3 in the Data Appendix lists the 41 countries and the availability of industry coverage. Table A4 lists 36 industries, ISIC code and the value of external financial dependence per industry.

5. Empirical Results

In this section we present estimation results for stocks and flows of a total-credit measure and of credit aggregates. We then proceed with a variety of robustness checks and a discussion of our findings.

5.1. Credit stocks, credit flows and their growth effects

Table 3 presents the results of the fixed-effect panel baseline model (columns 1-3) and the system-GMM model (columns 4-6). Results for credit stocks are in columns (1) and (4), results for credit flows in column (2) and (5). Credit stocks, the common measure for financial development, have no significant positive correlation to growth (Rousseau and Wachtel, 2011; Stengos et al., 2007; Valickova et al., 2013)). We go beyond this observation in columns (3) and (6). Where both stocks and flows are included, we observe negative (but weakly significant) growth effects of credit/GDP stocks. That is, controlling for the positive effect on spending of credit flows, financial development appears bad for growth. Credit-growth studies which do not control for the positive effect of credit flows will tend to overestimate the stock effect, which represents financial development. Even without controlling for flows (i.e. adopting the common methodology in the credit-growth literature), the growth effect of financial deepening was insignifcantly different from zero over 1990-2011.

[6] Using European micro-level data for 1996-2005, Bena and Ondko (2012) show that firms in industries with growth opportunities use more external finance in more financially developed countries. This result is particularly significant for firms that are more likely to be financially constrained and dependent on domestic financial markets, such as small and young firms. Kroszner et al. (2007) use a similar approach to show that sectors highly dependent on external finance experience a greater contraction during a banking

Table 3: Credit and Economic Growth: Stock and Flow Effects

	FE			System GMM		
	(1)	(2)	(3)	(4)	(5)	(6)
	Total Credit					
Credit stocks	-0.008		-0.013*	-0.02		-0.016**
	(0.005)		(0.007)	(0.014)		(0.007)
Credit flows		0.055	0.067		0.085	0.071
		(0.040)	(0.043)		(0.057)	(0.054)
Initial GDPPC	-5.632*	-7.132**	-6.210**	-2.618**	-3.071***	-2.271***
	(2.954)	(2.750)	(2.974)	(1.122)	(1.055)	(0.808)
Trade	0.012	0.014*	0.011	0.007**	0.006*	0.006**
	(0.009)	(0.008)	(0.008)	(0.003)	(0.003)	(0.003)
Government	-0.374**	-0.361**	-0.295	0.008	0.012	-0.004
	(0.163)	(0.171)	(0.182)	(0.050)	(0.060)	(0.046)
Inflation	-0.102	-0.112	-0.105	-0.112	-0.114	-0.113
	(0.097)	(0.099)	(0.098)	(0.094)	(0.088)	(0.087)
Education	0.54	0.42	0.455	0.249	0.293*	0.199
	(0.515)	(0.477)	(0.485)	(0.178)	(0.167)	(0.131)
Institutions	0.182***	0.189***	0.167***	0.259**	0.225**	0.200***
	(0.064)	(0.059)	(0.059)	(0.108)	(0.104)	(0.073)
Time FE	Yes	Yes	Yes	Yes	Yes	Yes
Observations	237	228	228	237	228	228
Number of id	46	46	46	46	46	46
R-squared	0.484	0.505	0.517			
AR(2)				0.485	0.651	0.617
Overidentification				0.403	0.383	0.346

Note: This table presents the results using total credit based on equations (3) and (4). Columns (1)-(3) present the FE results, columns (4)-(6) show the system-GMM results. The dependent variable is the average growth rate of real GDP per capita (constant 2005 US dollar) over each 3-year period. Credit stocks and flows are defined as in equations (1) and (2). Initial GDPPC is real GDP per capita at the beginning of each 3-year period. Trade is imports plus exports, divided by GDP. Government is government consumption divided by GDP. Inflation is the change in CPI. Education is average years of schooling. Institutions is the ICRG composite country risk measure. AR(2) is the Arellano-Bond serial correlation test (we report the p-value); Over-identification is the Hansen J statistic (we report the p-value). All specifications include time dummies (coefficients not reported). Coefficients for the constant are not reported. Robust standard errors are in parentheses, *** $p<0.01$, ** $p<0.05$, * $p<0.1$.

We proceed to distinguish 'nonfinancial' from 'asset market' credit. Table 4 reports baseline model results in columns (1)-(6) and the corresponding system GMM results in columns (7)-(12), with identical coefficient signs as in the baseline panel results. In all specifications, the validity of the instruments and the absence of second-order autocorrelation could not be rejected.

We find that stocks of both credit aggregates correlate negatively to growth. The coefficient for nonfinancial credit is no longer significant in the system-GMM model. The coefficient for asset market credit is negative and significant in the system-GMM specification only. In column (12), a one standard deviation increase in the stock of asset-market credit corresponds to 0.74 standard deviation decrease in the growth rate, which is equal to a 1.83 percentage points decrease in growth in this sample.[8] Considering that the average growth rate in our sample is 2.3 percentage points, the effect is large.

In contrast to the effect of credit stocks, nonfinancial credit flows are positively correlated to growth, significantly so in the system-GMM specification. This is not true for credit flows to asset markets, which have insignificant coefficients throughout. The result in column (9) implies that a one standard deviation increase in nonfinancial credit flows is associated with a 0.32 standard deviation increase in growth, which is equal to an additional 0.79 percentage point increase in growth in this sample.[9] Overall, the results suggest that controlling for endogeneity, the growth effect of financial deepening of asset markets was negative. Any positive growth effect of the increase in credit was an effect of nonfinancial credit flows, not of financial deepening.

5.2. Industry-level evidence

Estimation results applying the Rajan-Zingales (1998) methodology are shown in Table 5. We note that their 'external dependence on finance' is itself a flow of finance. It is defined as the annual excess of investment over profit, i.e. the annual flow of bank credit and other borrowing to finance investment. Columns (1)-(3) show the results for total credit, columns (4)-(6) and columns (7)-(9) report results for nonfinancial credit and credit to asset markets, respectively. The results are in line with the panel data estimations. We find that the coefficient for credit stocks is again consistently negative, with more significant coefficients for credit to asset markets. The positive coefficients for the interaction of credit stocks and financial dependence suggest that industries which are more dependent on external finance experience smaller growth-retarding effects from credit stocks. The coefficient for nonfinancial credit flows is clearly positive; but again, this is not the case for flows of credit to asset markets, where coefficients are insignificantly different from zero. Coefficients for the interaction terms between credit flows and external financial dependence are also insignificant. This is unsurprising given the definition of external financial dependence. The bottom panel of Table 5 reports marginal effects. The implied growth difference between high ED and low ED industries is 3 to 4 percentage points growth.

5.3. The interactions of credit stocks and flows

So far, we treated the growth effects of credit stocks and flows independently, as if the effect of obtaining new loans is independent of debt levels. One can think of a number of plausible mechanisms linking both, in most cases weakening the positive growth effect of credit flows at higher levels of credit stocks (Stockhammer, 2004; Cecchetti and Kharroubi, 2012). Not accounting for these effects might partly drive

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crisis in countries with deeper financial systems. Raddatz (2006) shows that sectors with larger liquidity needs are more volatile and experience deeper crises in financially underdeveloped countries.

[7] As the industry-specific deflators are not available across a large number of countries, we choose to deflate industry nominal value added by the country-specific consumer price index (CPI), as in Braun and Larrain (2005). Albeit imperfect, this provides a good approximation for a wide range of countries in our sample.

[8] The calculation is: (-0.057*32.2)/2.475=0.74. 32.2 and 2.475 are one standard deviation of asset-market credit stocks and one standard deviation of the output growth rate, respectively.

[9] The calculation is 0.189*4.24/2.475=0.32, where 4.24 and 2.475 are one standard deviation of nonfinancial credit flows and output growth rate, respectively.

Table 4: Credit Aggregates and Economic Growth

	FE						System GMM					
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
	Nonfinancial credit			Asset market credit			Nonfinancial credit			Asset market credit		
Credit stocks	-0.030**		-0.039**	0.002		-0.005	-0.026		-0.013	-0.032*		-0.057**
	(0.014)		(0.016)	(0.008)		(0.009)	(0.043)		(0.014)	(0.016)		(0.027)
Credit flows		0.104	0.129*		0.073	0.079		0.208**	0.189*		0.018	0.052
		(0.064)	(0.065)		(0.053)	(0.055)		(0.092)	(0.103)		(0.059)	(0.097)
Initial GDPPC	-4.469	-7.044**	-4.765	-6.778**	-7.507**	-7.429**	-2.803*	-2.360**	-2.685***	-1.582**	-2.869***	-1.587*
	(3.114)	(2.767)	(3.220)	(2.896)	(2.835)	(2.908)	(1.472)	(0.948)	(0.790)	(0.613)	(0.879)	(0.812)
Trade	0.009	0.013*	0.008	0.017*	0.018**	0.017**	0.007**	0.005**	0.006**	0.006***	0.007**	0.006*
	(0.009)	(0.008)	(0.008)	(0.009)	(0.008)	(0.009)	(0.003)	(0.002)	(0.003)	(0.002)	(0.003)	(0.003)
Government	-0.363**	-0.362**	-0.285	-0.419**	-0.388**	-0.373*	-0.003	0.008	0.015	-0.01	0.006	0.002
	(0.161)	(0.170)	(0.177)	(0.170)	(0.173)	(0.186)	(0.069)	(0.050)	(0.051)	(0.041)	(0.052)	(0.056)
Inflation	-0.102	-0.113	-0.109	-0.118	-0.118	-0.116	-0.116	-0.114	-0.125	-0.093	-0.111	-0.091
	(0.095)	(0.100)	(0.097)	(0.102)	(0.102)	(0.103)	(0.093)	(0.083)	(0.089)	(0.081)	(0.091)	(0.087)
Education	0.665	0.429	0.614	0.281	0.21	0.209	0.27	0.246*	0.268*	0.119	0.231	0.107
	(0.554)	(0.476)	(0.513)	(0.427)	(0.425)	(0.430)	(0.221)	(0.143)	(0.140)	(0.099)	(0.146)	(0.129)
Institution	0.177***	0.183***	0.158**	0.187***	0.188***	0.183***	0.231*	0.170*	0.212***	0.161**	0.201**	0.226***
	(0.064)	(0.059)	(0.059)	(0.067)	(0.064)	(0.063)	(0.122)	(0.089)	(0.074)	(0.078)	(0.081)	(0.072)
Time FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	237	228	228	228	219	219	237	228	228	228	219	213
Number of id	46	46	46	44	44	44	46	46	46	44	44	43
R-squared	0.495	0.506	0.53	0.497	0.517	0.517						
AR(2)							0.415	0.807	0.748	0.569	0.707	0.804
Overidentification							0.408	0.331	0.598	0.627	0.386	0.607

footnotesize Note: This table presents the results using total credit based on equations (3) and (4) . Columns (1)-(3) present the FE results, columns (4)-(6) show the system-GMM results. The dependent variable is the average growth rate of real GDP per capita (constant 2005 US dollar) over each 3-year period. Credit stocks and flows are defined as in equations (1) and (2). Initial GDPPC is real GDP per capita at the beginning of each 3-year period. Trade is imports plus exports, divided by GDP. Government is government consumption divided by GDP. Inflation is the change in CPI. Education is average years of schooling. Institutions is the ICRG composite country risk measure. AR(2) is the Arellano-Bond serial correlation test (we report the p-value); Over-identification is the Hansen J statistic (we report the p-value). All specifications include time dummies (coefficients not reported). Coefficients for the constant are not reported. Robust standard errors are in parentheses, *** p<0.01, ** p<0.05, * p<0.1.

Table 5: Credit and Economic Growth: Industry-Level Results

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
	Total credit			Nonfinancial credit			Asset market credit		
Credit stocks	-0.030**		-0.044***	-0.034		-0.064**	-0.069***		-0.084***
	(0.013)		(0.014)	(0.027)		(0.028)	(0.021)		(0.024)
ED*credit stocks	0.053***		0.054***	0.089**		0.099**	0.095***		0.094**
	(0.019)		(0.021)	(0.040)		(0.042)	(0.036)		(0.040)
Credit flows		0.134**	0.175***		0.387***	0.429***		0.067	0.154*
		(0.053)	(0.056)		(0.121)	(0.124)		(0.077)	(0.089)
ED*credit flows		0.016	-0.021		-0.007	-0.062		0.056	-0.022
		(0.090)	(0.095)		(0.186)	(0.192)		(0.154)	(0.164)
Initial share	0.473*	0.543**	0.539**	0.474*	0.537**	0.534**	0.234	0.303	0.3
	(0.260)	(0.261)	(0.261)	(0.259)	(0.260)	(0.260)	(0.226)	(0.226)	(0.228)
Observations	5,415	5,182	5,182	5,415	5,182	5,182	5,306	5,073	5,073
Number of countries	41	41	41	41	41	41	41	41	41
R-squared	0.447	0.457	0.459	0.446	0.459	0.46	0.417	0.425	0.427
Marginal Effects of credit stocks									
for high dependence industry	-0.006		-0.019	0.007		-0.018	-0.025		-0.041
for low dependence industry	-0.026		-0.039	-0.027		-0.056	-0.061		-0.076
Implied differential effect	0.02		0.02	0.02		0.038	0.036		0.035

Note: This table presents the industry-level evidence based on equation (5). Columns (1)-(3) presents the results for total credit, columns (4)-(6) for 'nonfinancial credit' (the sum of nonfinancial business and consumption credit) and columns (7)-(9) for 'asset market credit' (the sum of financial business and mortgage credit). The dependent variable is the average growth rate of real value added over each 3-year period. Credit stocks and flows are defined as in equations (1) and (2). ED is external dependence on finance, taken from Rajan and Zingales (1998). Initial share is the share of each industry in a country's s total manufacturing value added at the beginning of each 3-year period. All estimations include a constant and country, year, industry, industry-year and industry-country dummies (coefficients not reported). Country-time controls include initial GDP per capita at the beginning of each 3-year period, trade openness, government spending, inflation, education and institution, as in the country-level regressionsin table 4. The last three rows show the marginal growth effect of credit stocks for an industry in the 75th percentile and an industry in the 25th percentile in the external finance dependence index. The difference between these two is the implied differential effect. All standard errors in parentheses are adjusted for industry-country level heteroskedasticity and autocorrelation, *** $p<0.01$, ** $p<0.05$, * $p<0.1$.

our results through omitted-variable bias. We therefore introduce an interaction term of credit flows with stocks (i.e., with financial development). Table 6 reports the results. We find a negative interaction effect between credit stocks and credit flows for nonfinancial credit and for total credit, with weak significance. At higher levels of financial development (credit stocks), the growth effect of credit flows is smaller. We can think of at least two interpretations: diminishing returns to credit and a balance sheet effect where more debt leads to lower spending. While these interpretations should be the subject of future research, here our primary aim is to note that the stock and flow effects of credit aggregates in this specification are consistent with (though less significant than) our earlier results: insignificant for stocks, positive for flows.

5.4. Robustness tests

We run a number of robustness checks. Table 7 summarizes the findings. Due to space limitations, we do not include full regression tables, which are available on request. We first explore how the results change when we replace the two credit aggregates with their components. This is motivated by the concern that the aggregates might be hiding heterogeneity in the credit-growth relations of their underlying components. We report fixed-effect results for each of the four underlying credit categories in columns (1a)-(4a) and system-GMM results in columns (1b)-(4b). We find that the negative relations between credit stocks and growth holds overall but is particularly strong for non-financial business credit (column (1a)) and mortgage credit (column (3b)). This is unsurprising since they constitute the bulk of their respective aggregates. None of the four components have coefficients with an opposite sign to their aggregate. This suggests that the stock aggregates do not hide significant heterogeneity in the underlying credit-growth relations. Credit flows to non-financial business are positively related to growth. Coefficients for flows of mortgage and consumer credit are both insignificant in the system-GMM results.

Further, a potential bias may arise from the equal treatment of countries with high and low levels of credit stocks if the relation between credit and growth is nonlinear over credit stocks. First, we check whether our results are driven by countries with high credit stocks but low growth (Denmark, Spain and Switzerland) or low credit levels but high growth (Armenia, India and Uruguay). We drop these six countries and report results for 'nonfinancial credit' and 'asset market credit' in columns (5a)-(6a) and columns (5b)-(6b). Second, we test whether the results are similar in countries with high and low levels of credit stocks. We construct two sub-samples based on the distribution of the average credit stocks per country, one excluding countries in the lowest quantile (a 'high-credit-stocks' subsample), and the other excluding the highest quantile (a 'low-credit-stocks' subsample). Results are shown in columns (7a)-(10a) and (7b)-(10b). In both analyses, our results do not qualitatively change.

Moreover, Rousseau and Wachtel (2011) find that the positive relationship that was estimated using the data from the 1960s to the 1980s disappeared over the subsequent 15 years as a result of the increased incidence of crises. They show that once crises episodes are removed, the positive coefficient remains intact. Other papers show that indeed the link between credit and growth varies over the business cycle (Braun and Larrain, 2005; Borio, 2013; Jordà et al., 2013). The concern may then be that our results are driven by the extraordinary 2008-2011 years. To explore this, we construct a new sample by excluding the post-2007 observations and re-estimate both our specifications in columns (11a)-(12a) and (11b)-(12b). The results are consistent with our longer sample.

We also address Rousseau and Wachtel (2011)'s argument by including the Laeven and Valencia (2013) systematic banking crises variable. We characterize a 3-year country observation as a crisis episode if the country was in crisis for at least one year during this period.[10] Of the 46 countries in our sample, 20 experienced at least one crisis episode. We introduce an interaction term between credit stocks and crisis episodes, controlling for any independent effect of crises on growth. The results in columns (13a)-(14a) and (13b)-(14b) show that the coefficient for nonfinancial credit stocks is significant and negative in the fixed effect estimation, the coefficient for asset market credit is significant and negative in the GMM estimation, just as in Table 4. Our results are not driven by country-specific banking crisis.

[10] Alternatively, we characterize a 3 year episode as *crisis* if the country was in crisis for at least two years during a three-year

Table 6: Credit and Economic Growth: Stock and Flow Effects

	FE			System-GMM		
	(1)	(2)	(3)	(4)	(5)	(6)
	Total credit	Nonfinancial	Asset market	Total credit	Nonfinancial	Asset market
Credit stocks	-0.005	-0.028	0.012	0.01	0.011	0.004
	(0.007)	(0.017)	(0.009)	(0.010)	(0.024)	(0.021)
Credit flows	0.184***	0.299***	0.304***	0.141	0.239*	0.124
	(0.041)	(0.070)	(0.085)	(0.085)	(0.131)	(0.242)
Stocks * flows	-0.001***	-0.002***	-0.002***	-0.000*	-0.001*	-0.001
	0.000	0.000	(0.001)	0.000	(0.001)	(0.001)
Initial GDPPC	-6.787**	-5.089	-8.049***	-4.124**	-3.817***	-2.938**
	(2.850)	(3.232)	(2.678)	(1.624)	(1.417)	(1.233)
Trade	0.013	0.009	0.020**	0.006	0.006	0.006**
	(0.008)	(0.008)	(0.009)	(0.004)	(0.004)	(0.003)
Government	-0.256	-0.26	-0.348*	0.045	0.048	0.007
	(0.177)	(0.176)	(0.178)	(0.083)	(0.081)	(0.055)
Inflation	-0.114	-0.117	-0.122	-0.127	-0.131	-0.111
	(0.095)	(0.096)	(0.097)	(0.102)	(0.102)	(0.093)
Education	0.499	0.648	0.155	0.402	0.393*	0.231
	(0.453)	(0.493)	(0.385)	(0.248)	(0.226)	(0.177)
Institutions	0.157***	0.146**	0.180***	0.304**	0.311**	0.198*
	(0.054)	(0.055)	(0.059)	(0.149)	(0.129)	(0.099)
Observations	228	228	219	228	228	219
Number of id	46	46	44	46	46	44
R-squared	0.548	0.548	0.552			
AR(2)				0.979	0.962	0.892
Overidentification				0.288	0.483	0.415

Note: This table reports results including the interactions of credit stocks and flows. Columns (1) and (4) use total credit, whereas columns (2), (5) and (3), (6) use 'nonfinancial credit' (the sum of nonfinancial business and consumption credit) and 'asset market credit' (the sum of financial business and mortgage credit), respectively. Columns (1)-(3) present the FE results, columns (4)-(6) show the system-GMM results. The dependent variable is the average growth rate of real GDP per capita (constant 2005 US dollar) over each 3-year period. Credit stocks and flows are defined as in equations (1) and (2). Initial GDPPC is the real GDP per capita at the beginning of each 3-year period. Trade is imports plus exports, divided by GDP. Government is government consumption divided by GDP. Inflation is the change in CPI. Education is average years of schooling. Institutions is the ICRG composite country risk measure. AR(2) is the Arellano-Bond serial correlation test (p-value is reported); Over-identification is the Hansen J statistic (p-value is reported). All specifications include constants and time dummies (coefficients are not reported). Robust standard errors in parentheses, *** $p<0.01$, ** $p<0.05$, * $p<0.1$.

Table 7: Robustness Analyses

Panel A: FE														
	(1a)	(2a)	(3a)	(4a)	(5a)	(6a)	(7a)	(8a)	(9a)	(10a)	(11a)	(12a)	(13a)	(14a)
	The four categories of credit				*Country outliers*		*Level of credit stocks*					*The role of crisis*		
	NonFin	Consumer	Mortgage	FinBus	NF	AM	NF_HD	NF_LD	AM_HD	NF_HD	NF	AM	NF	AM
Credit stocks	-0.060***	-0.059	-0.005	-0.004	-0.070***	-0.009	-0.032*	-0.070**	0.004	0.001	-0.067***	-0.023	-0.067***	-0.023
	(0.017)	(0.040)	(0.009)	(0.028)	(0.018)	(0.013)	(0.016)	(0.026)	(0.009)	(0.023)	-0.018	-0.023	(0.018)	(0.023)
Credit flows	0.198***	0.076	0.067	0.099*	0.223***	0.169***	0.103*	0.251***	0.036	0.264**	0.236***	0.105	0.236***	0.105
	(0.069)	(0.151)	(0.076)	(0.050)	(0.054)	(0.056)	(0.057)	(0.060)	(0.039)	(0.099)	-0.063	-0.087	(0.063)	(0.087)
Crisis													-1.117	-0.385
													(0.803)	(0.809)
Crisis*Credit stocks													0.031**	0.011
													(0.013)	(0.010)
Time FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	228	199	219	183	204	197	173	176	166	167	182	175	182	175
Number of id	46	39	44	37	40	39	33	37	32	35	46	44	46	44
R-squared	0.542	0.48	0.512	0.506	0.556	0.522	0.632	0.573	0.64	0.555	0.392	0.308	0.392	0.308
Panel B: System-GMM														
	(1b)	(2b)	(3b)	(4b)	(5b)	(6b)	(7b)	(8b)	(9b)	(10b)	(11b)	(12b)	(13b)	(14b)
	NonFin	Consumer	Mortgage	FinBus	NF	AM	NF_HD	NF_LD	AM_HD	NF_HD	NF	AM	NF	AM
Credit stocks	-0.017	-0.057	-0.033*	-0.041	-0.054	-0.015	-0.023	-0.031	-0.007	-0.054	-0.035	-0.056*	-0.035	-0.056*
	(0.019)	(0.041)	(0.019)	(0.048)	(0.036)	(0.021)	(0.034)	(0.027)	(0.013)	(0.044)	-0.023	-0.029	(0.023)	(0.029)
Credit flows	0.273***	0.096	0.023	-0.139	0.203**	0.004	0.058	0.211**	-0.021	-0.013	0.332***	0.112	0.332***	0.112
	(0.097)	(0.133)	(0.047)	(0.206)	(0.090)	(0.073)	(0.079)	(0.086)	(0.051)	(0.241)	-0.088	-0.188	(0.088)	(0.188)
Crisis													-2.438*	-1.246
													(1.274)	(1.012)
Crisis*Credit stocks													0.055**	0.030*
													(0.022)	(0.018)
Observations	228	199	219	183	204	197	173	176	166	167	182	175	182	175
Number of id	46	39	44	37	40	39	33	37	32	35	46	44	46	44
AR(2)	0.696	0.909	0.755	0.766	0.931	0.851	0.268	0.875	0.187	0.821	0.793	0.641	0.793	0.641
Overidentification	0.515	0.579	0.57	0.19	0.384	0.448	0.211	0.459	0.356	0.536	0.527	0.492	0.527	0.492

Note: This table presents the robustness analyses. Panel A reports FE results, Panel B reports corresponding system-GMM results. *NF* denotes 'nonfinancial credit' (the sum of nonfinancial business and consumption credit) and AF denotes 'asset market credit' (the sum of financial business and mortgage credit). *HD* denotes the "high-credit-stocks" subsample, whereas *LD* denotes the "low-credit-stocks" subsample. Columns (1a)-(4a) and (1b)-(4b) examines the relations between each of the four underlying credit categories, namely nonfinancial business, consumer, mortgage and financial business credit and growth. Columns (5a)-(6a) and (5b)-(6b) drop outlier countries with high credit stocks/low growth (i.e., Denmark, Spain and Switzerland) and low credit levels/high growth (i.e., Armenia, India and Uruguay). Columns (7a)-(10a) and (7b)-(10b) consider the differential credit-growth relations in countries with high and low levels of credit stocks. Columns (11a)-(14a) and (11b)-(14b) examine the role of crisis. The dependent variable is the average growth rate of real GDP per capita (constant 2005 US dollar) over each 3-year period. Credit stocks and flows are defined as in equations (1) and (2). Initial GDPPC is real GDP per capita at the beginning of each 3-year period. Trade is imports plus exports, divided by GDP. Government is government consumption divided by GDP. Inflation is the change in CPI. Education is average years of schooling. Institutions is the ICRG composite country risk measure. *Crisis* is a dummy variable that takes the value of one if a country was in crisis for at least one year during a 3-year period, and zero otherwise. The identification of crisis is based on Laeven and Valencia (2013). All specifications include control variables, constants and time dummies (coefficients not reported). AR(2) is the Arellano-Bond serial correlation test (p-value is reported); over-identification is the Hansen J statistic (p-value is reported). Robust standard errors in parentheses, *** p<0.01, ** p<0.05, * p<0.1.

6. Conclusion

Financial deepening is a double-edged sword. It supports investments and increases the economy's capacity to reallocate factors of production. But a large credit-to-GDP ratio may be a drag on growth. It may imply high levels of private debt, reduce investment and innovation, and induce volatility, financial fragility and crisis. We show that credit to real estate and other asset markets tends to increase the credit-to-GDP ratio while stocks of credit to nonfinancial business rise roughly in line with GDP. In recent decades, a shift in the composition of credit towards real estate and other asset markets has therefore coincided with rising credit-to-GDP ratios and diminishing growth effectiveness of credit. Our paper suggest that a "[d]istinction between debts according to purpose, however difficult to carry out", as Schumpeter (1939, p. 148) wrote, may help understand developments in the growth effectiveness of credit.

We review the literature on the growth effectiveness of bank credit, which has markedly declined since the 1990s. We present and analyze new, hand-collected data for 46 economies over 1990-2011, and document and explore trends in credit categories. We observe positive correlations of nonfinancial-sector credit flows with output growth, and substantial negative correlation of credit stocks with output growth. This holds up in fixed-effect panel data regressions, dynamic panel estimations (system-GMM models), in regressions with the Rajan and Zingales (1998) methodology, and in robustness checks. We find that the growth coefficient of different credit stocks scaled by GDP is insignificant or negative, especially credit stocks supporting asset markets. These results are confirmed in an industry-level difference-in-difference analysis.

We also distinguish between stock and flow effects. We find positive growth effects of credit flows to nonfinancial business and insignificant or negative effects of credit flows to asset markets (including real estate). The positive effect of credit flows diminishes at higher levels of financial development.

These results are in line with declined growth effectiveness as a result of a shift in the use of bank credit. Credit flows have shifted away from nonfinancial business (with positive growth effects) and towards asset markets (with no or smaller growth effects). This shift towards more credit to asset markets also implies faster growth of credit stocks relative to GDP, which may be harmful in itself.

Our data and analysis suggest that what was true in the 1960s, 1970s and 1980s when the field of empirical credit-growth studies blossomed, is no longer true in the 1990s and 2000s. Banks do not primarily lend to nonfinancial business and financial development may no longer be good for growth. These trends predate the 2008 crisis. They prompt a rethink of the role of banks in the process of economic growth .

Our findings are consistent with a world which has too much rather than too little financial development. Piketty (2014) suggests that a large ratio of capital to income may depress growth, where capital is the sum of financial and fixed capital. His empirical work shows that most of the increase in the capital-income ratio is due to the increase in the value of financial assets. In our data, we observe large increases in bank lending supporting asset markets and insignificant or negative growth correlations of these credit stocks. Summers (2013) suggests that equilibrium real interest rates may have been declining over the last decades, possibly to negative values. In this view, more financial development leading to more savings, more financial capital and more debt will not stimulate growth. Our estimates show that even though credit flows may still constitute a stimulus to growth, credit stocks - the traditional measure for financial development - have negative or insignificant growth coefficients.

The common theme between these analyses and our paper appears to be that there are costs to having an economy and a financial system increasingly geared towards growing markets for real estate and financial assets. This opens up a wide array of research questions. It is not clear that these trends arise because of growing inequality, as Piketty suggests. It is unclear which of the many reasons suggested by Summers are relevant to negative real returns. We do not know whether the finance-growth relation we document for the last two decades is a temporary or secular trend. These are subjects for future research.

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period. Our results are quantitatively similar.

Data Appendix

The aim of the database is to provide a detailed description of monetary financial institutions' (banks and credit unions) loan assets where the counterparty is a domestic non-government nonbank. We collected data from the consolidated balance sheet of monetary financial institutions from central bank sources of 46 countries over 1990-2011. On the asset side of the balance sheet, loans to nonbanks are reported. We included a country in the data set if loans were reported separately for mortgages to households, household consumption credit, credit to nonfinancial business, and credit to financial business (insurance firms, pension funds, and other nonbank financial firms).[11]

Lending to government by banks is usually a very small paprt of total bank lending. We choose not to include this in our data. Mortgages in our data are household mortgages, which is only part of total mortgages. Some countries also report business mortgage lending separately from other lending to business, and in these cases it is clear that a substantial part of lending to business is lending secured by real estate. But the use of secured lending to business will be more linked to production and trade, and thus GDP, while the use of mortgages to household is almost exclusively to purchase real estate assets. Thus, the impact on GDP will be different, which suggest that separating out households mortgages is functional, but separating out business mortgages is less so. Apart from that, it was not practicable to do this. Since only few countries report business mortgages, we cannot consistently include total mortgages.

Domestic bank credit includes loans by both domestic and foreign banks, in domestic and foreign currency. For reasons of consistency, it excludes non-bank lending and securitized bank loans. Some countries have large nonbank debt markets or much securitization, so that loan assets on banks' balance sheets paint only a small part of the picture. For one extreme example, this is why 'total bank credit' values for the US are comparatively low: most credit in the US is nonbank credit (bonds and short term paper) and a large part of loans (especially, mortgages) is securitized so that it cannot be observed on banks' balance sheets. The total stock of credit market instruments relative to GDP in the US was 386% in 2011 (BEA flow of fund data), of which only 34% was bank credit (this data). However, the US is exceptional in this respect.

For each country, the source was always the country's central bank. There is large diversity in reporting formats. Only few central banks distinguish deposit taking institutions within the broader category of Monetary Financial Institutions. Most do not differentiate between lending to public sector firms and private sector firms, or between domestic currency loans and foreign currency loans. Some central banks (e.g. Switzerland's) report credit to ten or fifteen business sectors of the economy separately, which we collapsed into 'financial' and 'nonfinancial'. Some report bank lending to nonbanks as well as interbank lending (which we excluded from the data). Some report only 'household' and 'business' lending. In these cases, we assigned household lending to mortgages, unless we had evidence that it was unsecured consumer lending. Some data go back much before 1990; Switzerland's goes back to 1906, the US to 1952. But on average, data before 1990 were rare.

Comparison to Similar Data

Beck et al. (2012) and Büyükkarabacak and Valev (2010) were the first to study similar data, using a data set for 73 countries over the years 1994 to 2005. These papers are ground breaking in that they are the first studies to look at growth effects of different credit aggregates across countries. Our data is not an update of this, but is newly collected. The principal reason is that s. We aimed to separate out mortgage and other household credit and to observe each credit category at source. The Beck et al. (2012) data combines mortgage and other household credit into one household credit category. The data is based on the financial development and structure (FDS) data base described in Beck et al. (2000) and updated in Beck et al. (2010). Here "private credit" captures the financial intermediation with the private nonfinancial sector, including mortgages, as explained in note 5 in Beck et al. (2000) ("claims on real estate (=mortgage credit) is included

[11] An alternative would be to collect data from the liabilities side of the counterparty, in a country's flow of fund data. However, not all countries provide sufficiently detailed flow of funds data on bank loans by sector. What is often reported is total borrowing, including equity market borrowing while we focus on the analysis of bank credit. Also, to the extent that equity is held in the private nonfinancial sector, this is a debt from the private nonfinancial sector to the private nonfinancial sector.

for nonbanks lending"). In observing the different credit aggregates, Beck et al. (2012) start with a 'total credit' (TC) measure taken from the FDS data base, which is credit to nonfinancial business (BC) plus credit to households. The 'household credit' measure in Beck et al. (2010) and in Büyükkarabacak and Valev (2010) is defined as (TC-BC), i.e. all non-business credit, including both consumer credit and mortgage credit. These are not distinguished. The Beck et al. (2012) credit data are deflated by the CPI deflator and then divided by real (deflated) GDP. Our data is nominal credit divided by nominal GDP.

Table A2 is a comparison of our data to the Beck et al. (2012) data. We find that the data are mostly in agreement, except for a few countries. In the Czech Republic, our credit/GDP ratio is about half of those in the two other data sets. Personal communications with the Czech National Bank suggest that part of the reason is widespread credit write-downs and therefore data revisions since 2005, a large reduction in the number of banks, and the inclusion of foreign banks. The same applies to Slovakia, Iceland and Uruqay. For Sweden, our data yield a credit/GDP ratio which is much higher than in the Beck et al (2012) data, which is about double the Büyükkarabacak and Valev (2010) measure. Reclassifications of what counts as a bank may be behind this. There is also some disparity on the United Kingdom.

A more recent and somewhat comparable data set is the March 2013 Bank of International Settlement 'Long series on credit to private non-financial sectors' (BIS, 2013). A description of the data is in Dembiermont et al. (2013), including a link to data documentation. In the BIS data, only 'lending by all sectors' (i.e. bank and securities markets) is disaggregated to households and enterprises (except for Brazil, Portugal, Saudi Arabia and Russia). Bank debt is not disaggregated. This implies on one hand that the BIS data provide a more complete picture of all loans to the private sector, while on the other hand they do not include lending to the nonbank financial sector (which is substantial in some countries). Another limitation of the BIS data is that by including in one credit measure also nonbank lending (which mostly is lending through securities markets), it is not possible to study the unique role of bank loans. Since bank debt is not disaggregated, we cannot directly compare the BIS data to our data.

Table A.1: Credit stocks across countries (% of GDP)

Country	Start	End	Nonfinancial business	Consumer	Mortgage	Financial Business	Total
ALB	2005	2011	23.468		6.541	32.775	62.784
ARM	2005	2011	11.163	4.069	1.938	0.39	17.17
AUS	1994	2011	34.748	7.462	48.507	8.001	98.718
AUT	1995	2011	47.674		38.202	6.609	92.485
BEL	1999	2011	30.167	5.185	28.032	9.669	73.053
BGR	1998	2011	25.722	6.408	5.261		37.391
BRA	1994	2011	19.671	5.755	2.067	3.887	31.38
CAN	1990	2011	40.139	25.225	43.519	11.652	120.535
CHE	1990	2011	43.161		92.931	1.516	137.608
CHL	1990	2011	43.381	36.427	11.262		91.07
CZE	1997	2011	24.613	5.287	8.591	3.089	41.58
DEU	1990	2011	52.973	10.874	28.532	3.204	95.583
DNK	2000	2011	44.121	25.34	78.656	7.189	155.306
EGY	1991	2011	36.225	7.714			43.939
ESP	1992	2011	59.497	61.904	106.719		228.12
EST	1999	2011	22.55	2.161	20.497	6.496	51.704
FIN	2002	2011	27.272	13.409	33.675	0.685	74.356
FRA	1993	2011	36.177	12.514	26.556	4.111	79.358
GBR	1990	2011	21.11	8.693	36.584	26.032	92.419
GRC	1990	2011	34.011	7.142	15.43	0.984	56.583
HKG	1990	2011	68.83	11.604	39.323	15.192	134.949
HRV	2001	2011	61.143		32.591	9.446	103.18
HUN	1990	2011	15.393	3.325	5.279	3.316	27.313
IDN	2002	2011	15.269	5.33	1.994	2.44	25.033
IND	2001	2011	25.292	3.259	3.248	2.364	34.163
ISL	2003	2011	14.132		41.737		55.869
ISR	1999	2011	57.681	10.545	20.44		88.666
ITA	1998	2011	22.691	2.776	23.921	11.673	61.061
JPN	1990	2011	56.62	3.211	28.048	8.538	96.417
LTU	1993	2011	18.373	2.981	7.35	1.732	30.436
LUX	1999	2011	30.183	8.318	33.755	50.92	123.176
MAR	2001	2011	14.651	2.906	11.232	0.293	28.789
MEX	2000	2011	7.955	3.109	8.69		19.754
NLD	1990	2011	49.114	8.104	60.016	19.99	137.224
NOR	1995	2011	33.606	11.069	49.059	2.875	96.609
NZL	1990	2011	32.034	4.846	55.136	25.089	117.105
POL	1996	2011	14.785	9.476	7.048	1.201	32.51
PRT	1990	2011	41.924	11.202	37.904	10.876	101.906
SGP	1990	2011	59.365		23.2	13.397	95.962
SVK	2004	2011	19.773	4.337	11.163	2.403	37.676
SVN	2004	2011	48.487	11.476	8.729	4.933	73.625
SWE	1996	2011	55.302	11.221	40.686	48.119	155.328
TWN	1997	2011	70.616	19.951	38.949	3.426	132.942
UKR	2005	2011	39.58		19.441	5.243	64.264
URY	2005	2011	13.883	8.908			22.791
USA	1990	2011	9.547	6.032	18.823		34.402

Table A.2: Comparison to other data sets

	Private Credit			Nonfinancial Business Credit			Household Credit		
	Ours	BECK2012	BUY2010	Ours	BECK2012	BUY2010	Ours	BECK2012	BUY2010
	1994-2005	1994-2005	1990-2006	1994-2005	1994-2005	1990-2006	1994-2005	1994-2005	1990-2006
AUS	0.777	0.823	0.806	0.311	0.279	0.285	0.466	0.544	0.52
AUT	0.84	1.005	1.035	0.486	0.653	0.683	0.354	0.352	0.352
BEL	0.651	0.744	0.748	0.315	0.314	0.319	0.336	0.43	0.439
BGR	0.198	0.219	0.245	0.148	0.145	0.157	0.05	0.075	0.088
CAN	1.029	0.962	1.012	0.396	0.188	0.128	0.633	0.773	0.892
CHE	1.369	1.603	1.6	0.445	0.604	0.62	0.924	1	0.98
CZE	0.347	0.484	0.481	0.272	0.314	0.309	0.075	0.171	0.172
DEU	0.97	1.053	1.053	0.558	0.653	0.605	0.412	0.4	0.375
DNK	1.277	0.894	0.338	0.379	0.133	0.095	0.898	0.761	0.247
EGY	0.495	0.446	0.432	0.411	0.372	0.355	0.083	0.075	0.073
EST	0.194	0.286	0.336	0.11	0.176	0.208	0.084	0.111	0.127
FRA	0.69	0.85	0.86	0.344	0.339	0.337	0.346	0.511	0.513
GBR	0.62	1.269	1.337	0.187	0.557	0.293	0.433	0.712	1.04
GRC	0.444	0.663	0.691	0.294	0.379	0.389	0.15	0.283	0.3
HUN	0.212	0.231	0.302	0.143	0.189	0.218	0.069	0.042	0.085
IDN	0.205	0.252	0.249	0.142	0.17	0.169	0.063	0.082	0.08
IND	0.249	0.219	0.227	0.203	0.156	0.159	0.046	0.063	0.068
ISL	0.551	0.918	0.916	0.118	0.492	0.39	0.434	0.426	0.526
JPN	0.903	1.549	1.105	0.596	1.07	0.747	0.307	0.479	0.357
LTU	0.159	0.149	0.177	0.126	0.104	0.13	0.032	0.045	0.064
MAR	0.224	0.187	.	0.122	0.14	.	0.102	0.046	.
MEX	0.179	0.186	0.194	0.078	0.087	0.122	0.101	0.099	0.072
NLD	1.093	1.639	1.152	0.465	0.63	0.478	0.628	1.01	0.98
NZL	0.861	1.118	1.152	0.301	0.703	0.444	0.56	0.415	0.718
POL	0.238	0.244	0.229	0.143	0.135	0.162	0.095	0.11	0.07
PRT	0.85	1.103	0.961	0.391	0.507	0.124	0.458	0.596	0.51
SVK	0.219	0.415	0.409	0.142	0.265	0.262	0.077	0.15	0.151
SVN	0.476	0.34	0.362	0.339	0.24	0.252	0.138	0.099	0.11
SWE	0.963	0.636	0.374	0.534	0.233	0.228	0.429	1	0.149
URY	0.219	0.392	0.329	0.143	0.194	0.174	0.077	0.198	0.155
USA	0.324	0.498	0.503	0.095	0.118	0.095	0.229	0.38	0.408

Note: BECK2012 and BUY2010 refer to Beck et al. (2012) and Büyükkarabacak and Valev (2010), respectively. This table shows the comparison of private credit (excluding financial business credit), non-financial business credit and household credit (the sum of consumer credit and mortgage credit) for 31 countries (that exist in all three dataset except MAR) between our dataset, Beck et al. (2012) and Büyükkarabacak and Valev (2010). We takes the average of our credit data during the period 1994-2005, which is in line with Beck et al. (2012) . As a result, LVA, FIN and KOR dropped out due to limited time span in our dataset. 15 countries in our dataset, namely BRA, CHL, ARM, HKG, HRV, ISR, ITA, ESP, NOR, TWN, UKR, LUX, SGP do not exist in either Beck et al. (2012) nor Büyükkarabacak and Valev (2010).

Table A.3: Industry coverage across countries

ALB(11), AUS(36), AUT(36), BEL(36), BGR(36), BRA(12), CAN(35), CHE (18), CHL(30), CZE(31), DEU(36), DNK(32), EGY(36), ESP(36), EST(36), FIN(34), FRA(36), GBR(36), GRC(36), HKG(9), HUN(36), IDN(36), IND(32), ISL(29), ISR(24), ITA(36), JPN(36), LTU(36), LUX(29), MAR(36), MEX(36), NLD(36), NOR(36), NZL(14), POL(36), PRT(36), SGP(36), SVK(34), SVN(36), SWE(36), TWN(28), URY(33), USA(34)

Note: The number in the parenthesis indicates the number of industries available.

Table A.4: Industry classification and external financial dependence

ISIC code	Sector	External Dependence (ED)
311	Food products	0.14
313	Beverages	0.08
314	Tobacco	-0.45
321	Textiles	0.4
322	Apparel	0.03
323	Leather	-0.14
324	Footwear	-0.08
331	Wood products	0.28
332	Furniture	0.24
341	Paper products	0.18
342	Printing and publishing	0.2
352	Other chemical products	0.22
353	Refineries	0.04
354	Petroleum and coal	0.33
355	Rubber products	0.23
356	Plastic products	1.14
361	Pottery	-0.15
362	Glass and products	0.53
369	Non-metal products	0.06
371	Iron and steel	0.09
372	Non-ferrous metal	0.01
381	Metal products	0.24
382	Machinery	0.45
383	Electrical machinery	0.77
384	Transport equipment	0.31
385	Professional equipment	0.96
390	Other manufacturing	0.47
3211	Spinning	-0.09
3411	Pulp and paper	0.15
3511	Basic chemicals	0.25
3513	Synthetic resins	0.16
3522	Drugs	1.49
3825	Office and computing	1.06
3832	Radio	1.04
3841	Ship building	0.46
3843	Motor vehicles	0.39

Note: The external dependence on finance is taken from Rajan and Zingales (1998).

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